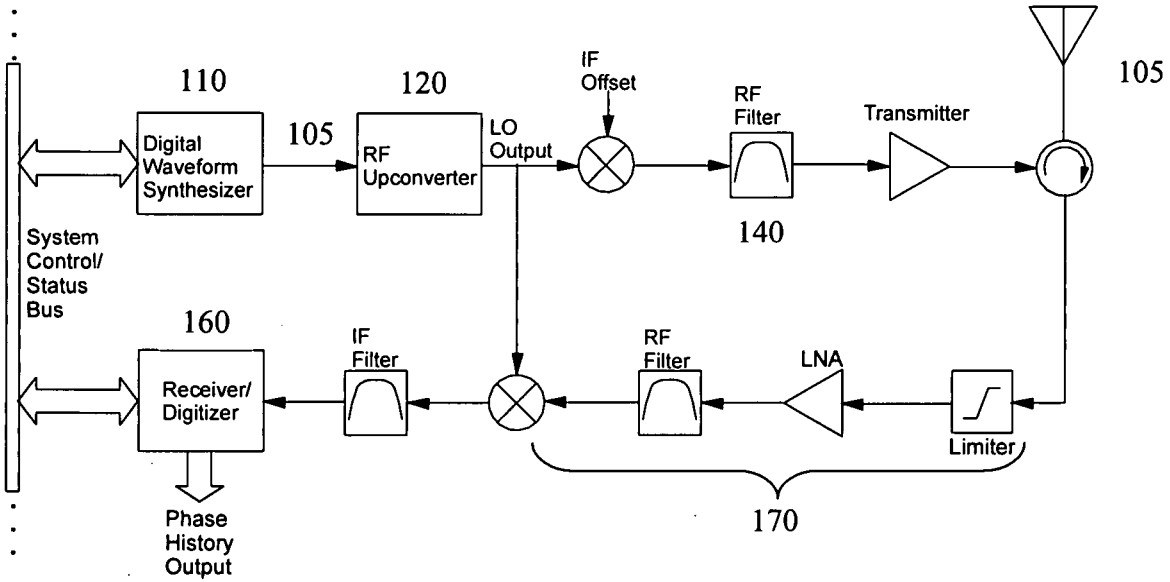
110
120
105
IF
Offset
RF
Filter
Transmitter
105
Digital
Waveform
Synthesizer
RF
Upconverter
LO
Output
System
Control/
Status
Bus
140
160
IF
Filter
RF
Filter
LNA
Receiver/
Digitizer
Limiter
170
Phase
History
Output

FIG. 1

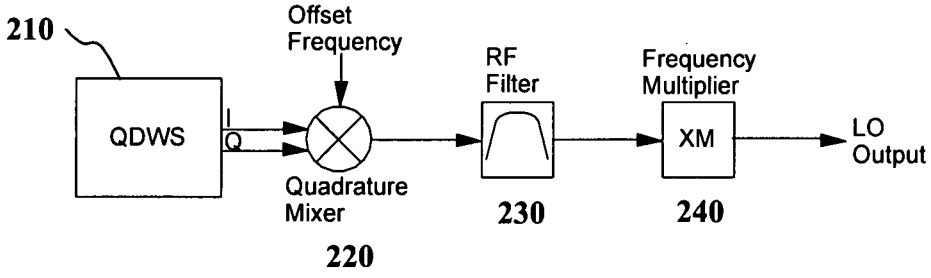
210
Offset
Frequency
RF
Filter
Frequency
Multiplier
QDWS
I
Q
XM
LO
Output
Quadrature
Mixer
230
240
220

FIG. 2

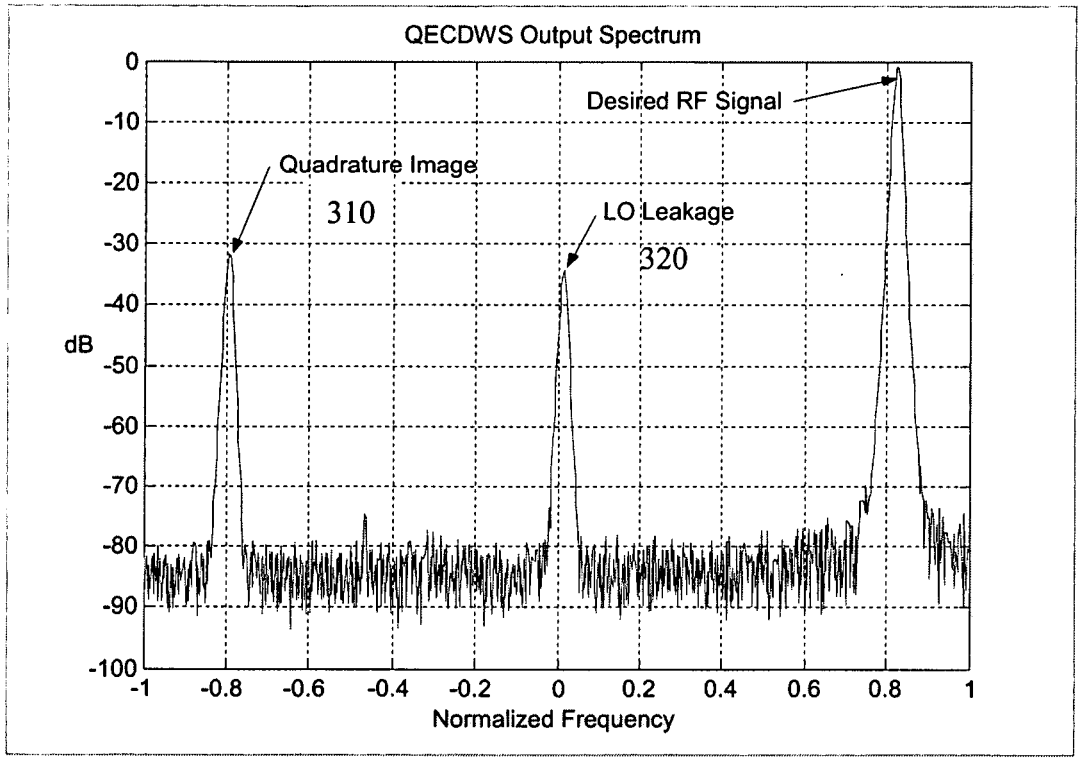
QECDWS Output Spectrum
Desired RF Signal
Quadrature Image
310
LO Leakage
320
dB
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
-1
-0.8
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8
1
Normalized Frequency

FIG. 3

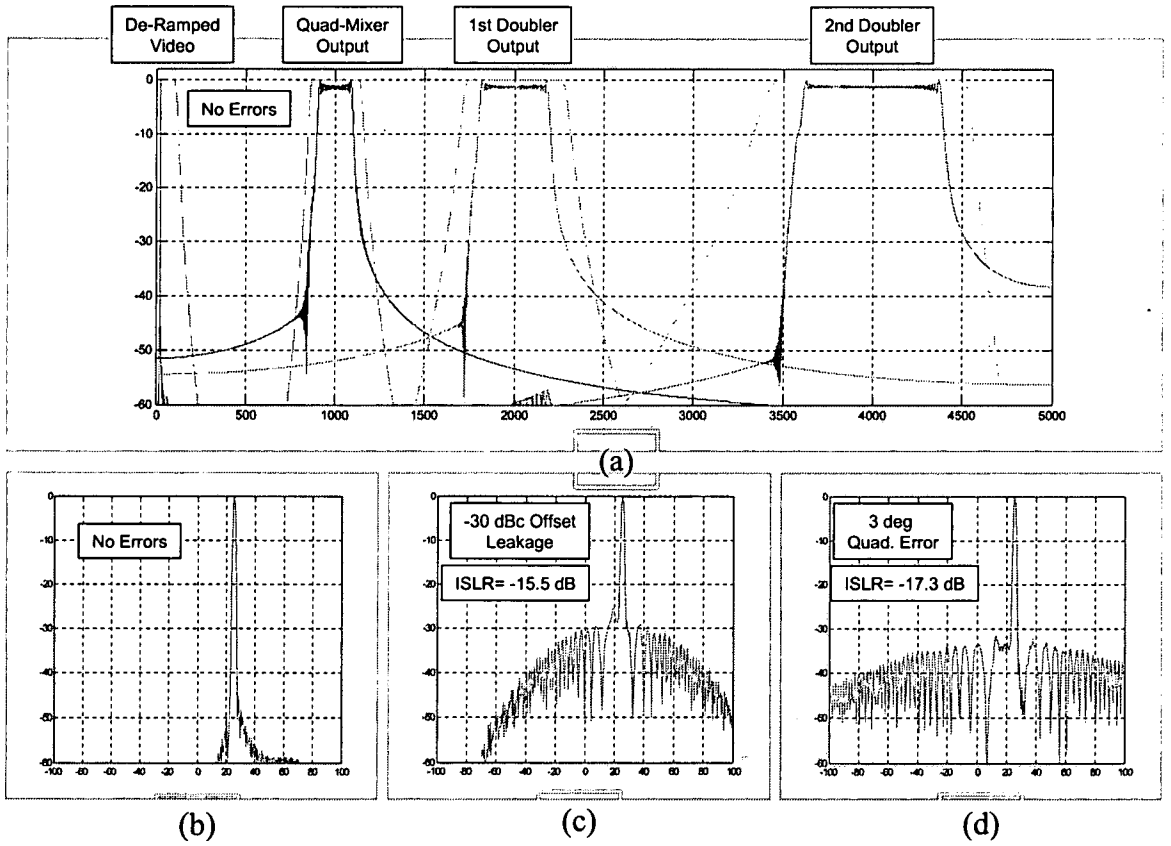
De-Ramped Video
Quad-Mixer Output
1st Doubler Output
2nd Doubler Output
No Errors
(a)
No Errors
-30 dBc Offset Leakage
ISLR= -15.5 dB
3 deg Quad. Error
ISLR= -17.3 dB
(b)
(c)
(d)

FIG. 4

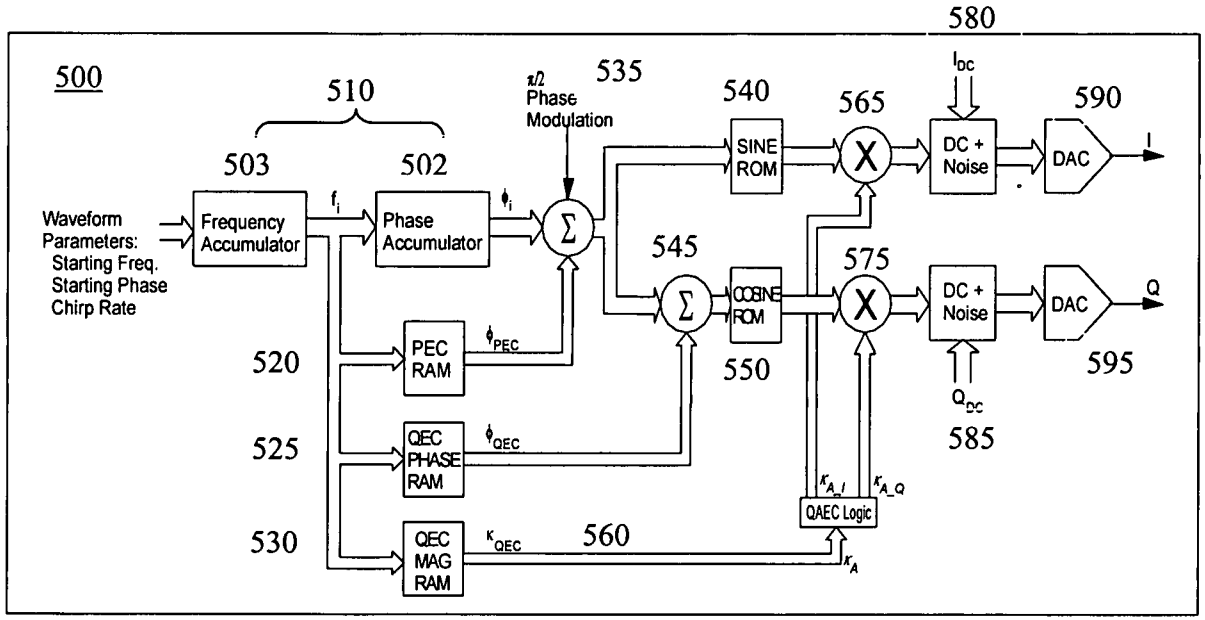
580
500
510
503
502
535
π/2 Phase Modulation
540
565
590
I_{DC}
Waveform Parameters:
Starting Freq.
Starting Phase
Chirp Rate
Frequency Accumulator
f_i
Phase Accumulator
ϕ_i
Σ
SINE ROM
X
DC + Noise
DAC
I
545
575
COSINE ROM
Σ
X
DC + Noise
DAC
Q
520
PEC RAM
ϕ_{PEC}
550
595
525
QEC PHASE RAM
ϕ_{QEC}
Q_{DC}
585
κ_{A_I}
κ_{A_Q}
QAEC Logic
530
QEC MAG RAM
κ_{QEC}
560
κ_A

FIG. 5

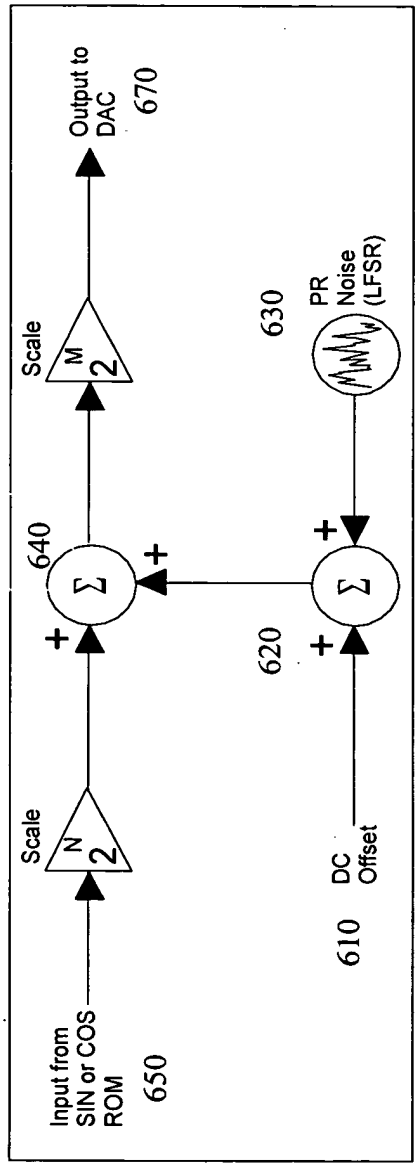
Input from SIN or COS ROM
650
Scale
N
2
610
DC Offset
620
640
Σ
+
+
+
+
630
PR Noise (LFSR)
Scale
M
2
Output to DAC
670

FIG. 6

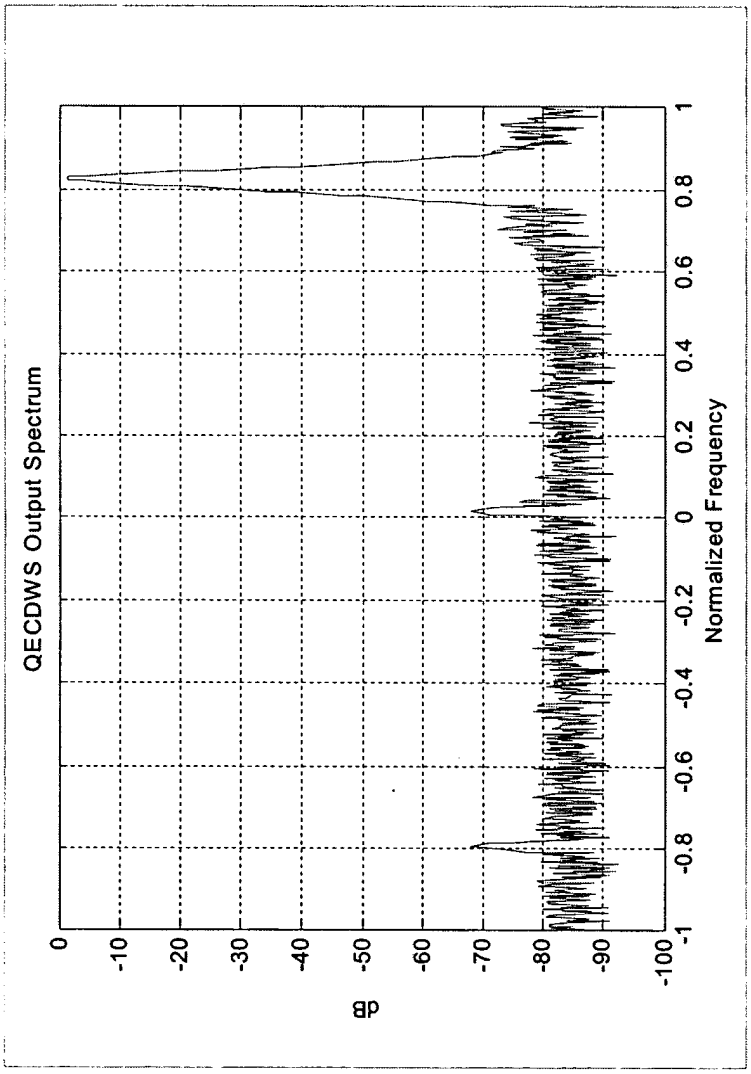
QECDWS Output Spectrum
dB
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
-1
-0.8
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8
1
Normalized Frequency

FIG. 7

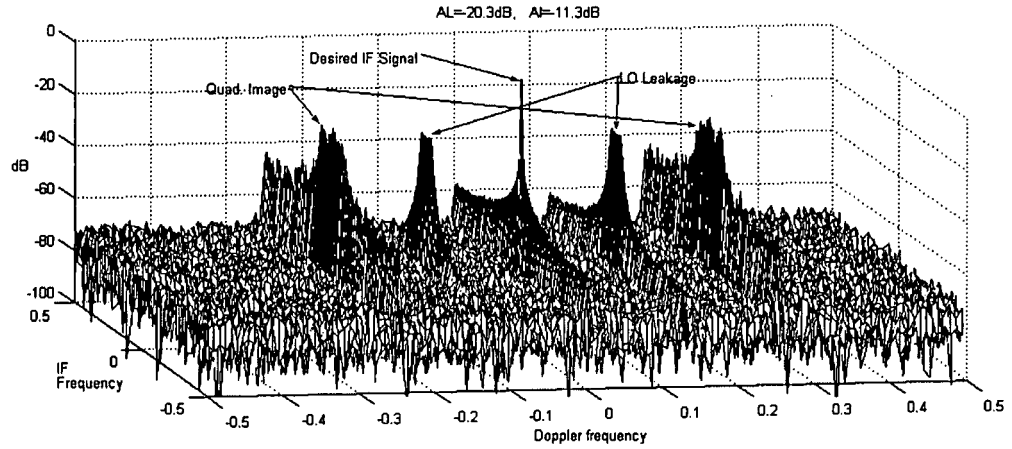
AL=-20.3dB, AI=-11.3dB
Desired IF Signal
Quad. Image
LO Leakage
dB
0
-20
-40
-60
-80
-100
0.5
IF Frequency
0
-0.5
-0.5
-0.4
-0.3
-0.2
-0.1
0
0.1
0.2
0.3
0.4
0.5
Doppler frequency

FIG. 8

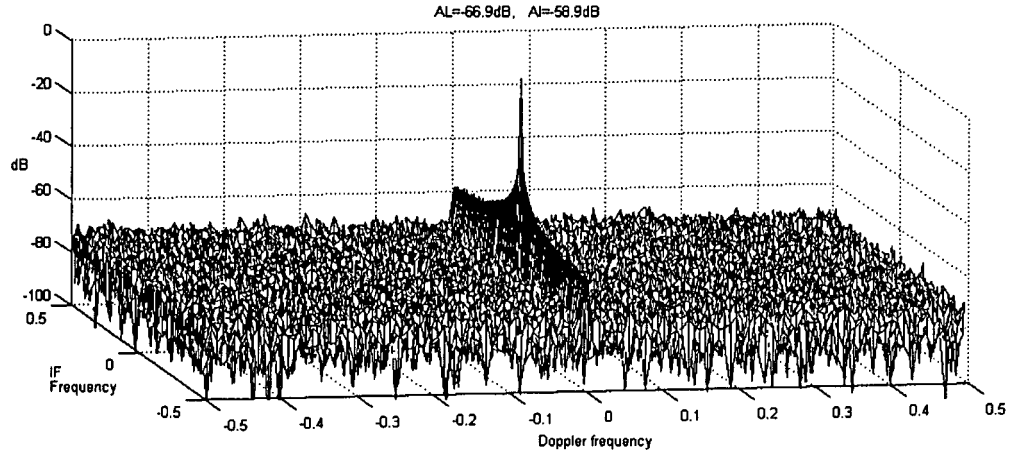
AL=-66.9dB, AI=-58.9dB
dB
0
-20
-40
-60
-80
-100
0.5
IF Frequency
0
-0.5
-0.5
-0.4
-0.3
-0.2
-0.1
0
0.1
0.2
0.3
0.4
0.5
Doppler frequency

FIG. 9

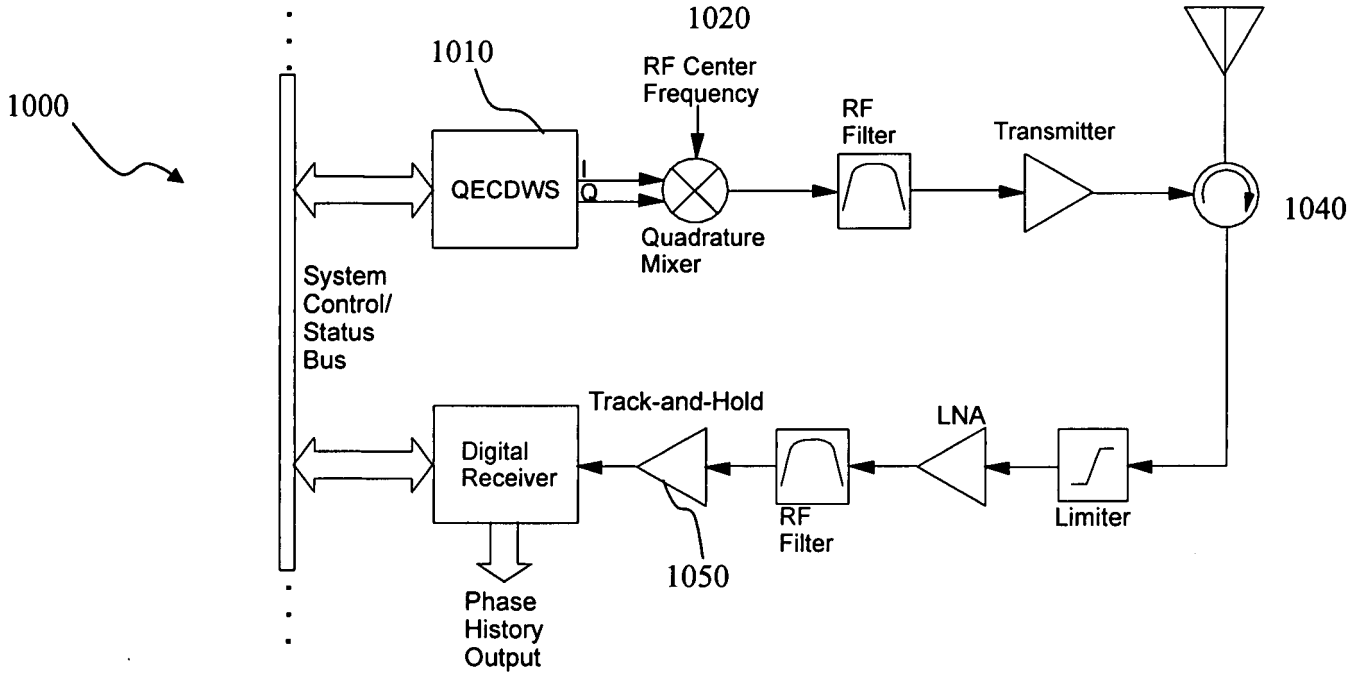
1000
1010
1020
RF Center Frequency
RF Filter
Transmitter
QECDWS
I
Q
Quadrature Mixer
1040
System Control/ Status Bus
Track-and-Hold
LNA
Digital Receiver
RF Filter
Limiter
1050
Phase History Output

FIG. 10